

PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
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in its capacity as elected Office

Date of mailing (day/month/year) 06 September 2000 (06.09.00)	
International application No. PCT/DK99/00724	Applicant's or agent's file reference 22029 PC 1
International filing date (day/month/year) 21 December 1999 (21.12.99)	Priority date (day/month/year) 21 December 1998 (21.12.98)
Applicant HARDER, Sven	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

20 July 2000 (20.07.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Nestor Santesso Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 22029 PC 1	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/DK 99/ 00724	International filing date (day/month/year) 21/12/1999	(Earliest) Priority Date (day/month/year) 21/12/1998
Applicant ICOPAL A/S et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the International search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the International search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2

☐ None of the figures.

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INTERNATIONAL SEARCH REPORT

International Application No

PC 99/00724

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04D12/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E04D E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 85 00188 A (V.I.K.- CONSULT) 17 January 1985 (1985-01-17) cited in the application the whole document	1-33
A	WO 96 33321 A (FRAUNHOFER-GESELLSCHAFT) 24 October 1996 (1996-10-24) cited in the application & EP148870 (Cited by the applicant) the whole document	1-33
A	EP 0 816 582 A (FRAUNHOFER-GESELLSCHAFT) 7 January 1998 (1998-01-07) column 3, line 10 - line 21	1
A	WO 98 25119 A (ICOPAL A/S) 11 June 1998 (1998-06-11) abstract; figures	1
-/-		



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

27 March 2000

Date of mailing of the international search report

31/03/2000

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No

P K 99/00724

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 657 610 A (KOMATSU ET AL.) 14 April 1987 (1987-04-14) the whole document	1
A	DE 30 46 861 A (RÜTGERSWERKE AG) 15 July 1982 (1982-07-15) the whole document	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 99/00724

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 8500188	A	17-01-1985	DK 563483 A, B, AT 23381 T EP 0148870 A FI 850680 A, B, JP 4053987 B JP 60501612 T NO 850643 A US 4567080 A	21-12-1984 15-11-1984 24-07-1985 19-02-1985 28-08-1992 26-09-1985 18-02-1985 28-01-1986
WO 9633321	A	24-10-1996	DE 19514420 C AU 695567 B AU 5331896 A BR 9608141 A CA 2215502 A CN 1185821 A CZ 9703218 A EP 0821755 A HU 9802610 A JP 11504088 T NO 974807 A NZ 305338 A PL 322730 A SK 142097 A	06-03-1997 13-08-1998 07-11-1996 09-02-1999 24-10-1996 24-06-1998 18-02-1998 04-02-1998 29-03-1999 06-04-1999 19-12-1997 23-12-1998 16-02-1998 04-02-1998
EP 816582	A	07-01-1998	DE 29611626 U NO 973090 A	12-09-1996 05-01-1998
WO 9825119	A	11-06-1998	AU 5187498 A EP 0943080 A	29-06-1998 22-09-1999
US 4657610	A	14-04-1987	JP 1894566 C JP 5064107 B JP 61202843 A CA 1245964 A EP 0193938 A	26-12-1994 13-09-1993 08-09-1986 06-12-1988 10-09-1986
DE 3046861	A	15-07-1982	NONE	

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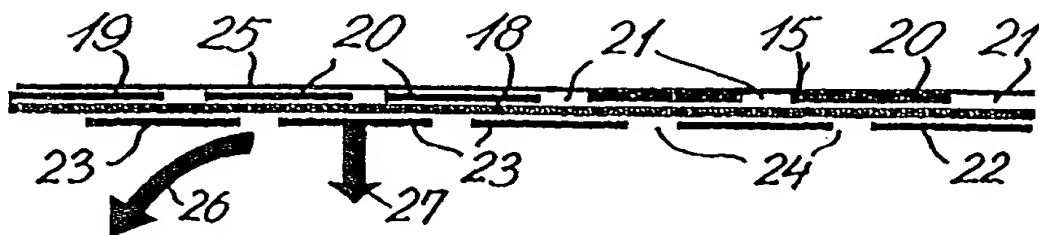
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With international search report

PLOUGMANN
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& PARTNERS

07 JULI 2000

(54) Title: A WATER VAPOUR BARRIER AND A METHOD OF MAKING THE SAME



(57) Abstract

The present invention relates to a water vapour barrier (15) that comprises a first, water impervious membrane (19) having a plurality of first through openings (21) defined therein, and a second, water impervious membrane (22) which is arranged opposite to the first membrane (19). A water absorbing material (18) is arranged within one or more spaces defined between the first and second membranes (19, 22), and the water vapour barrier (15) is characterised in that at least part of the second membrane (22) is of a material of the type having a water vapour diffusion resistance, which varies in dependency of the relative humidity of air in contact therewith, such that the vapour diffusion resistance is reduced when the relative humidity increases, and vice versa. The invention further relates to a method of making the water vapour barrier.

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A WATER VAPOUR BARRIER AND A METHOD OF MAKING THE SAME

The present invention relates to a water vapour barrier of the type used in building structures such as roof or wall structures. It is well known to use such vapour barriers in the form of plastic films or other sheet materials between a roof or wall structure and a ceiling or wall covering of a room in a building. Usually, the roof or wall structure defines cavities therein which are totally or partly filled with a heat insulating material. Due to for example leakage and/or water vapour condensation caused by variation in temperature moisture may accumulate in the cavities of the roof or wall structure, and such moisture may cause corrosion of structural elements of metal and fungus or rot attack on structural elements of wood.

The international patent application No. WO 96/33321 discloses a water vapour barrier for use in heat insulation of buildings. This known vapour barrier is in the form of a plastic film or a membrane of the type having a water vapour diffusion resistance, which varies in dependency of the relative moisture of surrounding air. This means that when the relative moisture within the roof or wall structure is high, the diffusion resistance of the vapour barrier will be low - typically a diffusion resistance equivalent to 0.2 m air column (according to DIN 52 615) - so that moisture from the cavities of the roof or wall structure may diffuse through the vapour barrier and into the room of the building. However, when the relative moisture on the warm side of the roof or wall structure is low, for example in the winter, the diffusion resistance of the vapour barrier will be higher, typically equivalent to 2 m air column - but a substantial amount of water vapour may diffuse from the room of the building into the roof or wall structure, which is undesirable. Furthermore, this known vapour barrier is water tight, which means that free water which may have leaked into cavities of the roof or wall structure is collected therein and can only very slowly diffuse or condense in the summer through the vapour barrier after having been vaporised.

The European patent No. EP 0148870 discloses a vapour barrier formed by a pair of vapour impervious plastic films made from polyethylene, and an intermediate water absorbing layer. The oppositely arranged vapour impervious plastic films have through openings defined therein. However, the openings in the opposite plastic films are offset or displaced in relation to each other. This known vapour barrier structure allows vapour to dry out through the barrier via condensation and by capillary action and the vapour diffusion resistance is dependent on the character of the intermediate layer of water

absorbing material and on the minimum spacings of adjacent openings in the opposite vapour impervious plastic films. This known water vapour barrier also allows free water accumulated within cavities of a roof or wall structure to be drained through the vapour barrier by capillary action. However, when this known laminated water vapour barrier is
5 used, vaporised moisture may dry out from the roof or wall structure through the vapour barrier via condensation and capillary action into an inner room of the building only when the relative humidity and the temperature difference between the roof or wall structure and the vapour barrier is such that vapour is condensed on the intermediate layer of water absorbing material which is exposed at the openings defined in the outer plastic film. This
10 means that the roof or wall structure may dry out only when there is a sufficiently fall of temperature in the roof or wall structure, such that the temperature outside is higher than the temperature in the room or inner space of the building.

The present invention provides an improved vapour barrier of the latter type. Thus, the
15 present invention provides a water vapour barrier comprising a first, water impervious membrane having a plurality of first through openings defined therein, a second, water impervious membrane arranged opposite to the first membrane, and water absorbing material being arranged within one or more spaces being defined between the first and second membranes, and the vapour barrier according to the invention is characterised in
20 that at least part of said second membrane is of a material of the type having a water vapour diffusion resistance, which varies in dependency of the relative humidity of air in contact therewith, such that the vapour diffusion resistance is reduced when the relative humidity increases, and vice versa.

25 The second membrane may have a plurality of second through openings defined therein, and the first through openings in the first membrane may be offset in relation to the second through openings in the second membrane, or the first and second openings may be placed opposite to each other.

30 Preferably, the water vapour barrier may be arranged such that the first membrane, which is impervious to water, is facing the room of the building while the second membrane through which water vapour may diffuse is facing outwardly towards the building structure. By means of the vapour barrier according to the invention moisture may be removed from a roof or wall structure or another similar building structure not only by draining of free
35 water and by removing condensed water vapour by capillary action like the known vapour

barrier, but also by diffusion. This means that the vapour barrier according to the invention is much more efficient in drying cavities or spaces in building structures, which may partly or totally be filled with insulating material, than any of the known vapour barriers.

- 5 Alternatively, the water vapour barrier according to the invention may be reversed arranged such that the first membrane, which is impervious to water, is facing outwardly towards the building structure, while the second membrane through which water vapour may diffuse is facing the room of the building.
- 10 Like the second water impervious membrane also the first membrane may be of the type having a water vapour diffusion resistance varying in dependency of the relative humidity of the ambient atmosphere. In the presently preferred embodiment of the water vapour barrier according to the invention, however, the first membrane is substantially impervious not only to water, but also to water vapour.

15

- The water absorbing material may, for example, be arranged within a plurality of pockets or spaces which are formed between the first and second membrane, and each of which interconnects one or more of said first openings in the first membrane with one or more of said second openings formed in the second membrane. Preferably, however, the first and
- 20 second membranes are connected to opposite sides of said water absorbing material, which is in the form of an intermediate layer, and the first through openings in the first membrane are offset in relation to the second through openings in the second membrane.

- The characteristics of the water absorbing material forming the intermediate layer, the
- 25 minimum spacing between adjacent first and second openings in the opposite first and second membranes, and the thickness of the intermediate layer may be chosen so as to obtain a desired draining effect and a desired resistance against moisture transmission from the first to the second openings by capillary action. It has been found that the thickness of the intermediate layer of water absorbing material should preferably be 0.2-
- 30 1.5 mm.

- In a preferred embodiment, the second openings cover a substantially larger area of the surface of the water absorbing material than the first openings, so that the vapour barrier is more open from the side where the second membrane is fastened, and thereby
- 35 provides that the vapour or water is easier transported in a direction from the second

membrane to the first membrane, due to the lower diffusion resistance of one side of the vapour barrier, and thereby a more rectified transport of the vapour or water in the vapour barrier is obtained. Alternatively, the first through openings may cover a substantially larger area of the surface of the water absorbing material than the second through
5 openings, so that the vapour barrier is more open from the side where the first membrane is fastened.

The intermediate layer may be formed by any suitably water absorbing material, such as a porous, moisture resistant material. Preferably, however, the intermediate layer is a
10 fibrous material and may comprise modified natural or man-made fibres, such as modified cellulose fibres or plastic fibres which may, for example, be impregnated with a fungicide. In the preferred embodiment the intermediate layer is formed by a mixture of plastic fibres, such as polypropylene and acrylic fibres. The fibres may have a core, which is hydrophobic, and an outer surface which is hydrophilic. Preferably, the weight of the
15 intermediate layer is 50-100 g/m².

The first membrane is, of course, not totally impervious to water vapour, but should preferably show a vapour diffusion resistance being equivalent to at least 10 m air column at any moisture conditions. Usually, the water vapour diffusion resistance of the first
20 membrane, which is said to be substantially impervious to water vapour, should be equivalent to 10-100 m air column at any relative humidity of air in contact therewith, but the water vapour diffusion resistance may also be equivalent to 2000 m air column or even higher depending on the chosen material, e.g., metal foils. The first membrane could be formed in situ, for example by spraying the membrane in a liquid condition on one side
25 surface of the intermediate layer of water absorbing material. Preferably, however, the first membrane is a film or foil made from a plastic or a metallic material, such as polyethylene, polypropylene, poly-vinyliden-chloride, coated films of metals, such as aluminium laminates, aluminium or an alloy thereof. In the presently preferred embodiment the first membrane comprises a polyethylene film having a weight of 20-100
30 g/m², preferably 30-80 g/m². Preferably, the thickness of the first membrane is 10-200 µm, such as 40-100 µm.

The water vapour diffusion resistance of the second membrane is preferably equivalent to at least 2 m air column at a relative humidity of 20-50% and less than 1 m air column at a
35 relative humidity of 60-100% of air in contact with the membrane. This means that when

- the water absorbing material is moist or the air within the water absorbing material has a high relative humidity the resistance against moisture diffusion from the water absorbing material through the second membrane and into the inner space or room of the building is low. Consequently, moisture may be removed from the cavities or spaces in the roof or wall structure relatively quickly. However, in winter time when the relative humidity on the side of the vapour barrier facing outwardly is lower than the relative humidity of the air inside the building, the resistance against diffusion of water vapour from the inner space or room of the building into the roof or wall structure is relatively high.
- 10 In a preferred embodiment, the water vapour diffusion resistance of the second membrane is even higher and may be equivalent to at least 5 m air column or even higher, such as up to 60 m air column, at a relative humidity of 20-50%. Furthermore, the water vapour diffusion resistance of the second membrane may be equivalent to less than 0.5 m air column, and preferably about 0.1 m or less at a relative humidity of 60-100% of
- 15 air in contact with the membrane, whereby the moisture transmission capacity of the vapour barrier is increased substantially. Preferably, the thickness of the second membrane is 10-100 μm , such as 10-60 μm .

The water vapour diffusion resistance of the vapour barrier may be equivalent to at least 0.2 m air column at a relative humidity of 60-100% or even higher, such as up to 100 m air column at a relative humidity of 20-50%. When the relative humidity is at the most 99%, the vapour barrier dries out moisture by diffusion, and when the relative humidity is 100%, the vapour barrier removes condensed water vapour by capillary action and free water by draining the free water, as the vapour diffusion resistance drops to approximately 0.05 m

25 air column when the relative humidity reaches 100%, e.g., in the summer period. This means that the vapour barrier according to the invention is much more efficient in drying cavities or spaces in building structures than known vapour barriers, as it is able to dry both by diffusion, condensation and drainage.

- 30 Oppositely, in the winter period when the relative humidity is 20-50%, the vapour diffusion resistance of the vapour barrier may be up to 100 m air column, and the vapour barrier may then substantially prevent vapour from diffusing from the room through the barrier and into the roof or wall structure, and it thereby prevents a moisture accumulation in the structure.

At least part of the second membrane may be made from any of the known materials having a water vapour diffusion resistance which is dependent on the relative humidity of air in contact therewith, for example the materials disclosed in the above mentioned international application WO96/33321. As example the second membrane may comprise

5 any of the following materials or any combinations thereof, namely polyamide, ethylene-vinyl alcohol-copolymer, polyvinyl alcohol, polyurethane, protein derivatives, methyl-cellulose, linseed oil alkyd, cellophane, and bone glue. Some of these materials are suitably made in the form of a film which is adhered to or laminated with the intermediate layer of water absorbing material. Other of the materials mentioned may be formed into
10 the second membrane by being applied to, for example sprayed onto a side surface of the intermediate layer of water absorbing material in a liquid condition. Preferably, the at least part of the second membrane constitute approximately 5-20% of the entire surface area of the vapour barrier, so as to obtain a preferred water vapour diffusion resistance of the vapour barrier.

15

An adhesive for adhering the first and/or second membrane to the layer of water absorbing material may be provided on the membrane(s) by coextruding the membrane(s) with the adhesive when producing the membrane(s). The adhesive may have perforations for retaining the permeability of the water vapour barrier in the adhering areas.

20

A preferred embodiment of the vapour barrier according to the invention further comprises a moisture distributing outer layer of water absorbing material which may be connected to the outer surface of the first and/or second membrane. Such moisture distributing layer may efficiently absorb and distribute free leakage water or condensed vapour and transfer

25 such water to the water absorbing material, which is positioned between the first and second membranes and exposed at the openings formed in the first membrane. This outer layer of water absorbing material may be of any suitable type, for example of the same type as that used in the water absorbing intermediate layer. Thus, the outer layer of water absorbing material may be a fibrous, felt-like material, which may, for example,
30 contain a mixture of plastic fibres. The thickness of this outer layer is preferably rather small, for example less than 0.5 mm and preferably about 0.1 mm. Preferably, the weight of the outer layer is 10-20 g/m².

The first and/or second membrane may be formed as a continuous layer extending along
35 the entire length of the vapour barrier. Thus, the vapour barrier may comprise first and/or

second membrane(s) being formed as continuous layers, so as to obtain a vapour barrier having a higher diffusion resistance. The first and/or second membranes may be continuous films or foils in which a plurality of openings, which may have any suitable contour, such as circular, elliptical, triangular or rectangular, are formed. Furthermore, the
5 total area of the openings in the first and second membranes may be different, thus, as an example the total area of the openings in the second membrane may exceed the area of the openings in the first membrane.

The openings in the first and/or second membrane may comprise perforations with a
10 closeness being between 200-600 holes per dm^2 . Preferably, the perforations constitute 1-20% of the entire area of the membrane, such as 2-15%. The perforations may be placed in preferred patterns or randomly in the membrane. In case the perforations comprise circular holes, the diameter of the holes may be between 0.5-10 mm, and the perforations may be punched or rolled in the membrane, e.g., by flame-rolling the holes.
15 The perforations in the first membrane may be offset in relation to the perforations in the second membrane, or the perforations in the first membrane may be positioned opposite to the perforations in the second membrane.

In the preferred embodiment the first and second membranes are formed by mutual
20 parallel, transversely spaced first and second bands or strips, respectively, and the first and second openings in the first and second membranes, respectively, are then defined between adjacent first and second bands, respectively. As mentioned above, the first and second openings do not mutually overlap, but should be offset. Preferably, the minimum spacing between first and second openings, which are defined in the first and second
25 membranes, respectively, is about 20 mm in order to obtain a sufficient resistance against the capillary transmission of water from a first opening in the first membrane to and adjacent second opening in the second membrane. Furthermore, the first and second bands may be perforated with perforations as described above.

30 When the first and second membranes are formed by first and second bands, respectively, each of the second bands may have a width exceeding the width of a corresponding strip-like space between adjacent first bands, so that such second band overlaps not only such space in the first membrane, but also adjacent rim portions of said adjacent first bands. In such case the maximum transverse overlap of the rim portions of

the adjacent first band may be 100 mm. However, preferably such maximum transverse overlap is 70 mm.

In the preferred embodiment the vapour barrier according to the invention is in the form of
5 a web-like material with the parallel, band-shaped or strip-like openings extending in the longitudinal direction of the web-like material.

In a further embodiment, the vapour barrier may comprise a combination of a first membrane being formed by first bands and a second membrane being formed as a
10 continuous layer extending along the entire length of the vapour barrier, or vice versa. The bands and the continuous layer may be perforated, and the perforations in the bands may be offset and/or positioned opposite in relation to the perforations in the continuous layer.

Preferably, the vapour barrier has a heating value being at the most 4 MJ/m², so that it
15 complies with the regulations concerning fire resistance.

One or more of the layers of the vapour barrier may comprise polyamid/nylon, so as to provide a vapour barrier having improved fire-retardant properties. When being burned nylon produces nitrogen which has a fire extinguishing effect.
20

Furthermore, it has been found that the vapour barrier according to the present invention has improved sound absorption properties.

The invention also provides a method of making a water vapour barrier of the type
25 described above, said method comprising forming an elongated layer of water absorbing fibrous material, applying to a first side surface of the layer of water absorbing material a plurality of transversely spaced, parallel first bands of a first, water impervious membrane material, and applying to an opposite, second side surface of the layer of water absorbing fibrous material a plurality of transversely spaced, parallel second bands, at least some of
30 which are of a second, water impervious membrane material, which is of the type having a water vapour diffusion resistance, which varies in dependency of the relative moisture of air in contact therewith, each of said second bands having a width exceeding the width of a corresponding space between adjacent first bands and being applied so as to overlap said space and adjacent rim portions of said adjacent first bands.

At least some of the first and second bands may be films or foils which are adhered to the side surfaces of the layer of water absorbing fibrous material. The first bands, may, for example, be polyethylene films or foils which are connected to thermoplastic fibrous of the layer of water absorbing material by heating or fusing. Preferably, at least some of the

5 second bands are fastened to the layer of water absorbing material by means of a glue, being applied at spaced locations. This may be done by interposing net-like bands of a suitable polymer glue between said second bands and the layer of water absorbing material and by subsequently activating the glue, for example by heating.

10 The invention will now be further described with reference to the drawings, wherein

Fig. 1 is a fractional sectional view of a roof structure including a water vapour barrier according to the invention,

15 Fig. 2 is a diagrammatic sectional view of an embodiment of the water vapour barrier according to the invention shown in an enlarged scale,

Fig. 3 is a perspective view of a rolled up web-like water vapour barrier according to the invention, and

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Figs. 4-8 are diagrammatic sectional views of further embodiments of the water vapour barrier according to the invention shown in enlarged scales.

The roof structure shown in Fig. 1 comprises a wooden frame including rafters 10 (only

25 one shown in Fig. 1) and a layer of boards 11, which are fastened to the upper sides of the rafters 10. The spaces defined between the rafters 10 and by the layer of boards 11 are filled with a heat insulating material, such as mineral wool 12. The layer of boards 11 is covered by an outer layer of roofing felt 13 and by a water tight film or foil 14 arranged between the roofing felt and the boards 11. The inner side of the heat insulating material

30 or mineral wool 12 is covered by a water vapour barrier 15 according to the invention, and the inner side of the vapour barrier is covered by lining plates, such as plasterboards 16 which are fastened to laths 17. The purpose of the water vapour barrier 15 shown in Fig. 1 is to allow possible moisture collected within the spaces defined between the rafters 10 to migrate through the vapour barrier 15 and into the room below the plasterboards 16. The

35 moisture may, for example, be free water having passed through possible leaks in the

roofing felt 13 and/or the film 14, or it may be condensed water vapour or air with a high relative humidity.

In the winter, the vapour diffusion resistance of the vapour barrier 15 may be up to 100 m air column, and the vapour barrier may then substantially prevent the moisture from diffusing from the room through the vapour barrier and into the roof structure, and it thereby prevents a moisture accumulation in the roof structure.

Figs. 2-8 show further embodiments of the water vapour barrier, and wherein like parts do have the same reference number.

Fig. 2 diagrammatically illustrates an embodiment 15 of the water vapour barrier according to the invention more in detail. The water vapour barrier 15 shown in Fig. 2 comprises an intermediate thin layer 18 of a water absorbent material, such as a fibrous material which may be a mixture of polypropylene fibres and acrylic fibres. The thickness of the layer 18 may, for example, be 0.5-1 mm. A first membrane 19 of a polyethylene film is fastened to the upper surface of the intermediate fibrous layer 18. The first membrane 19 is formed by a number of mutually parallel bands 20 of a polyethylene film. The bands or strips 20 are mutually transversely spaced so as to form band-like or strip-like openings 21 therebetween. A second membrane 22 is applied to the lower surface of the intermediate layer 18, for example by means of a polymer glue. The second membrane 22 is also formed by a number of parallel bands or strips 23 of plastic film. Each of these bands or strips is positioned opposite to one of the openings 21, so as to overlap not only this opening, but also adjacent rim portions of the bands 20. At least some of the bands or strips 23 are made from a plastic material of the type having a water vapour diffusion resistance which is dependent on the relative humidity of the air being in contact therewith. Thus, at least some of the strips 23 may be made from polyamide. Also the strips or bands 23 are mutually transversely spaced so as to define band-like or strip-like openings 24 therebetween, and as shown in Figs. 2 and 3 these openings are transversely offset in relation to the openings 21 formed in the first membrane 19. The opposite surface of the first membrane 19 is covered by a fibrous, water absorbing layer 25, which is preferably rather thin, for example 0.1 mm.

As explained above, moisture may pass from the spaces of the roof structure through the water vapour barrier and into an inner room of the building in various ways. Free water

which comes into contact with the outer water absorbing layer 25 will be distributed along the upper surface of the first membrane 19 and passed to the openings 21 in the first membrane where the water may come into contact with and be absorbed by the intermediate layer 18. Now, as indicated by an arrow 26 the water may be passed to the opening 24 in the second membrane 22 by draining or capillary effect. Furthermore, as long as the relative humidity of air within the roof structure and consequently at the openings 21 in the first membrane 19 is higher than in the room defined by the plasterboards 16, water vapour also diffuses through the second membrane 22 as indicated by an arrow 27 in Fig. 2. However, in case the relative humidity of air within the roof structure drops below the relative humidity of air in the inner space of the building, the vapour diffusion resistance of the second membrane will increase so that only negligible amounts of humidity may pass into the spaces defined by the roof structure.

Fig. 4 diagrammatically illustrates a further embodiment 15 of the water vapour barrier according to the invention. The water vapour barrier 15 of Fig. 4 differs from that of Fig. 2 in that the first membrane 19 is fastened to the lower surface of the intermediate layer 18 and the second membrane 22 is fastened to the upper surface of the intermediate layer 18, and in that the first membrane 19 is formed as a continuous layer extending along the entire length of the vapour barrier. The first membrane 19 comprises perforations 28 being positioned opposite to the strips 23 of the second membrane 22.

Fig. 5 diagrammatically illustrates a further embodiment 15 of the water vapour barrier. The water vapour barrier 15 of Fig. 5 differs from that of Fig. 2 in that the first membrane 19 is fastened to the lower surface of the intermediate layer 18 and the second membrane 22 is fastened to the upper surface of the intermediate layer, and in that the first membrane 19 is formed by a number of parallel bands or strips 20. The bands or strips 20 are mutually transversely spaced so as to form band-like or strip-like openings 21 therebetween, the openings 21 being offset in relation to the openings 24.

Fig. 6 diagrammatically illustrates a further embodiment 15 of the water vapour barrier. This embodiment differs from that of Fig. 2 in that the second membrane 22 is formed as a continuous layer extending along the entire length of the vapour barrier. The second membrane 22 comprises perforations 29 being positioned opposite to the strips 20 of the first membrane 19.

Fig. 7 diagrammatically illustrates a further embodiment 15 of the water vapour barrier. The water vapour barrier 15 of Fig. 7 differs from that of Fig. 2 in that the first membrane 19 is fastened to the lower surface of the intermediate layer 18 and the second membrane 22 is fastened to the upper surface of the intermediate layer 18, and in that the first and 5 second membrane 19,22 are formed as continuous layers extending along the entire length of the vapour barrier. The first membrane 19 comprises perforations 28 which are positioned opposite to the perforations 29 of the second membrane 22.

Fig. 8 diagrammatically illustrates a preferred embodiment 15 of the water vapour barrier. 10 The water vapour barrier 15 of Fig. 8 differs from that of Fig. 4 in that the water absorbing layer 25 of Fig. 4 is removed, and in that the second membrane 22 constitutes a smaller part of the upper surface area of the vapour barrier, so as to thereby obtain a more vapour open barrier. The first membrane 19 comprises perforations 28 being positioned opposite to the strips 23 of the second membrane. The more openness of the barrier provides that 15 the transport of vapour in a direction from the second membrane 22 to the first membrane 19 is predominant, and thereby a more rectified transport of the vapour or water in the vapour barrier is obtained.

It should be understood that the water vapour barrier according to the invention may also 20 be used in connection with other parts of buildings, such as wall or roof structures.

Because the water vapour barrier according to the invention allows moisture to pass from the outer to the inner side not only by capillary action, but also by diffusion, the vapour barrier according to the invention is much more efficient than similar known water vapour barriers.

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CLAIMS

1. A water vapour barrier (15) comprising
a first, water impervious membrane (19) having a plurality of first through openings
5 (21,28) defined therein,
a second, water impervious membrane (22) arranged opposite to the first
membrane (19),
water absorbing material (18) being arranged within one or more spaces being
defined between the first and second membranes (19,22), and
10 characterised in that at least part of said second membrane (22) is of a material of
the type having a water vapour diffusion resistance, which varies in dependency of the
relative humidity of air in contact therewith, such that the vapour diffusion resistance is
reduced when the relative humidity increases, and vice versa.
- 15 2. A vapour barrier according to claim 1, wherein a plurality of second through openings
(24,29) are formed in said second membrane (22), and wherein each of said spaces
interconnecting said first openings (21,28) and second openings (24,29).
3. A vapour barrier according to claim 2, wherein the first through openings (21,28) are
20 offset to said second through openings (24,29).
4. A vapour barrier according to any of claims 1-3, wherein the first membrane (19) is
substantially impervious to water vapour.
- 25 5. A vapour barrier according to any of claims 1-4, wherein the first and second
membranes (19,22) are connected to opposite sides of said water absorbing material,
which is in the form of an intermediate layer (18).
6. A vapour barrier according to claim 5, wherein the second through openings (24,29)
30 cover a substantially larger area of the surface of the water absorbing material than the
first through openings (21,28), or vice versa, whereby the vapour transport in the vapour
barrier in a direction from the second membrane to the first membrane is predominant, or
vice versa.

7. A vapour barrier according to claim 5 or 6, wherein the thickness of the intermediate layer (18) of water absorbing material is 0.2-1.5 mm.
8. A vapour barrier according to any of claim 5-7, wherein the intermediate layer (18) of water absorbing material is a fibrous plastic material comprising fibres having a hydrophobic fibre core.
9. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the first membrane (19) is equivalent to 10-100 m air column at any relative humidity of air in contact therewith.
10. A vapour barrier according to any of the preceding claims, wherein the first membrane is a film or foil (19).
11. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is made from plastic or metallic material.
12. A vapour barrier according to claim 11, wherein the first membrane (19) is made from polyethylene or polypropylene.
13. A vapour barrier according to claim 12, wherein the first membrane (19) comprises a polyethylene film having a weight of 20-100 g/m², preferably 30-80 g/m².
14. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 2 m air column at a relative humidity of 20-50% and less than 1 m air column at a relative humidity of 60-100% of air in contact with the membrane.
15. A vapour barrier according to claim 14, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 5 m air column at a relative humidity of 20-50%.
16. A vapour barrier according to claim 14 or 15, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to less than 0.5 m air column,

preferably about 0.1 m or less, at a relative humidity of 60-100% of air in contact with the membrane.

17. A vapour barrier according to any of the preceding claims, wherein said at least part of
5 the second membrane (22) is made from at least one material selected from the group consisting of polyamide, ethylene-vinyl alcohol-copolymer, polyvinyl alcohol, polyurethane, protein derivatives, methyl cellulose, cellophane, linseed oil alkyd, and bone glue.
- 10 18. A vapour barrier according to any of the preceding claims, further comprising a moisture distributing outer layer (25) of water absorbing material, which is connected to the outer surface of said first membrane (19) or second membrane (22).
- 15 19. A vapour barrier according to claim 18, wherein the outer layer (25) of water absorbing material is a fibrous, felt-like material.
- 20 20. A vapour barrier according to claim 19, wherein the thickness of the outer layer (25) of water absorbing material is less than 0.5 mm, preferably about 0.1 mm.
- 20 21. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is formed by mutually parallel, transversely spaced first bands (20), the first through openings (21) being defined between adjacent first bands (20).
- 25 22. A vapour barrier according to any of the preceding claims, wherein the second membrane (22) is formed by mutually parallel, transversely spaced second bands (23), the second through openings (24) being defined between adjacent second bands (23).
- 30 23. A vapour barrier according to any of the claims 2-22, wherein the minimum spacing between first and second openings (21,24) defined in the first and second membranes (19,22), respectively, is about 20 mm.
24. A vapour barrier according to claim 22, wherein each of said second bands (23) has a width exceeding the width of a corresponding space (21) between adjacent first bands (20) and overlaps said space and adjacent rim portions of said adjacent first bands.

25. A vapour barrier according to claim 24, wherein the maximum transverse overlap of the rim portions of the adjacent first bands (20) is 100 mm.

26. A vapour barrier according to claim 25, wherein the maximum transverse overlap is 70 mm.

27. A vapour barrier according to any of the claims 21-26 and being in the form of a web-like material, the parallel, band-shaped openings (21,24) extending in the longitudinal direction of the web-like material.

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28. A method of making a water vapour barrier, said method comprising
forming an elongated layer of water absorbing, fibrous material (18),
applying to a first side surface of the layer of water absorbing, fibrous material (18)
a plurality of transversely spaced, parallel first bands (20) of a first, water impervious
15 membrane material, and

applying to an opposite, second side surface of the layer of water absorbing,
fibrous material (18) a plurality of transversely spaced, parallel second bands (23), at least
some of which are of a second membrane material, which is of the type having a water
vapour diffusion resistance, which varies in dependency of the relative moisture of air in
20 contact therewith,

each of said second bands (23) having a width exceeding the width of a
corresponding space (21) between adjacent first bands (20) and being applied so as to
overlap said space and adjacent rim portions of said adjacent first bands.

25 29. A method according to claim 28, wherein said first membrane material is substantially
impervious to water vapour.

30. A method according to claim 28 or 29, wherein at least some of said first and second
bands (20,23) are films or foils which are adhered to the side surfaces of the layer of
30 water absorbing fibrous material (18).

31. A method according to claim 29 or 30, wherein the first bands (20) are polyethylene
films or foils which are connected to thermoplastic fibres of the layer (18) of water
absorbing material by heating and fusing.

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32. A method according to any of the claims 28-31, wherein at least some of the second bands (23) are fastened to the layer of water absorbing material (18) by means of a glue.

33. A method according to claim 32, wherein net-like bands of a suitable polymer glue are
5 interposed between said second bands (23) and the layer of water absorbing material (18).

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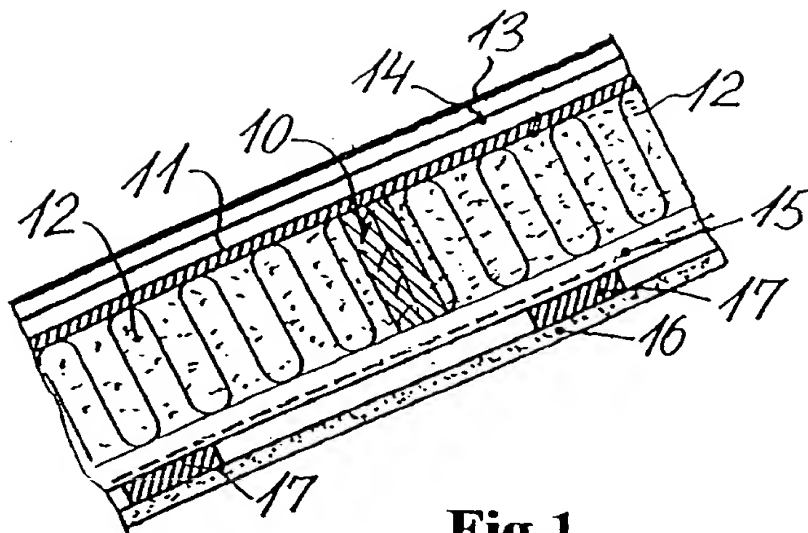


Fig. 1

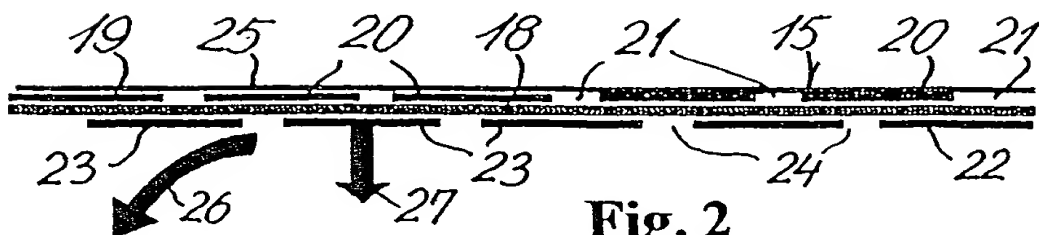


Fig. 2

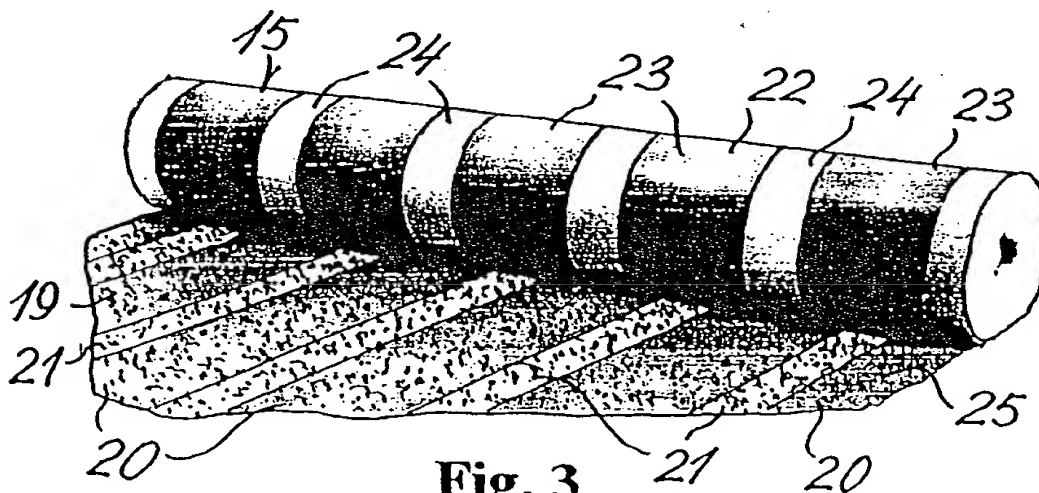


Fig. 3

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Fig. 4

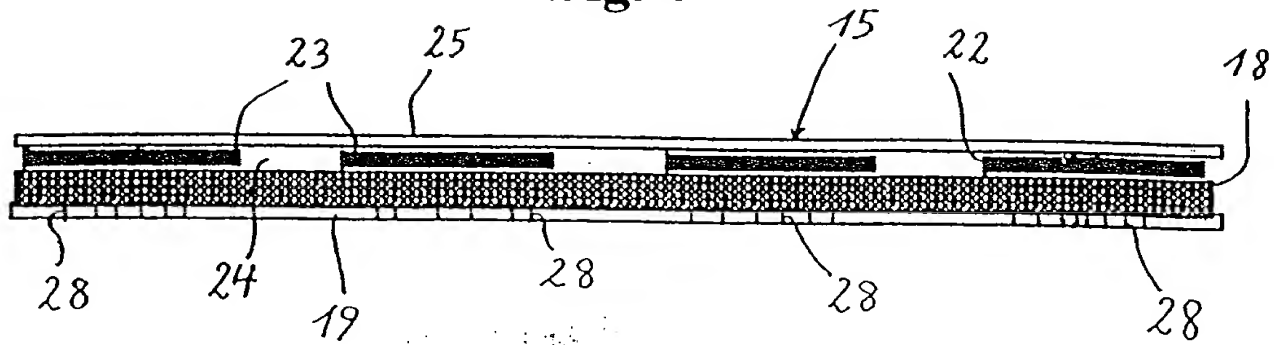


Fig. 5

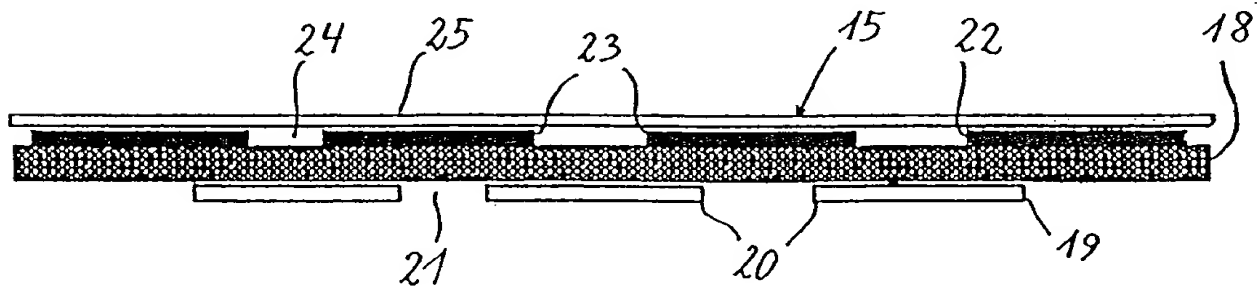
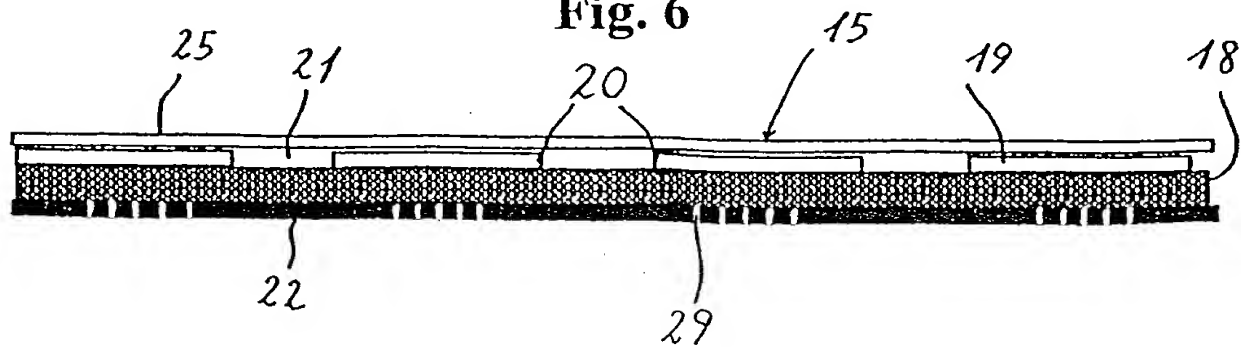


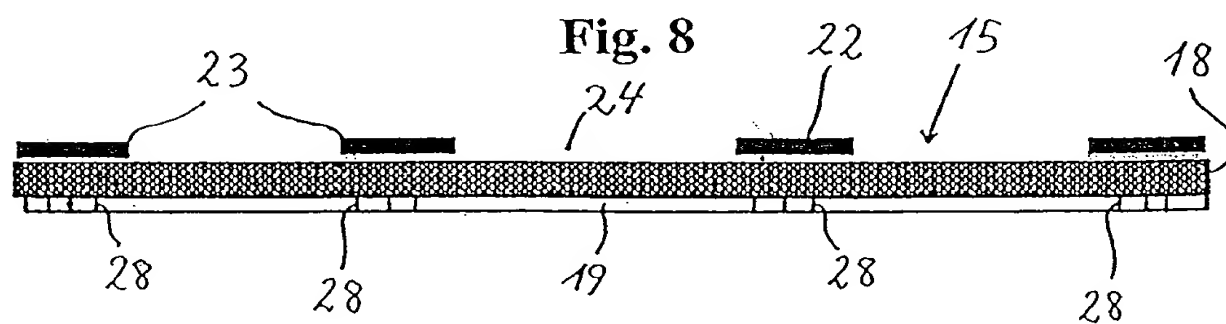
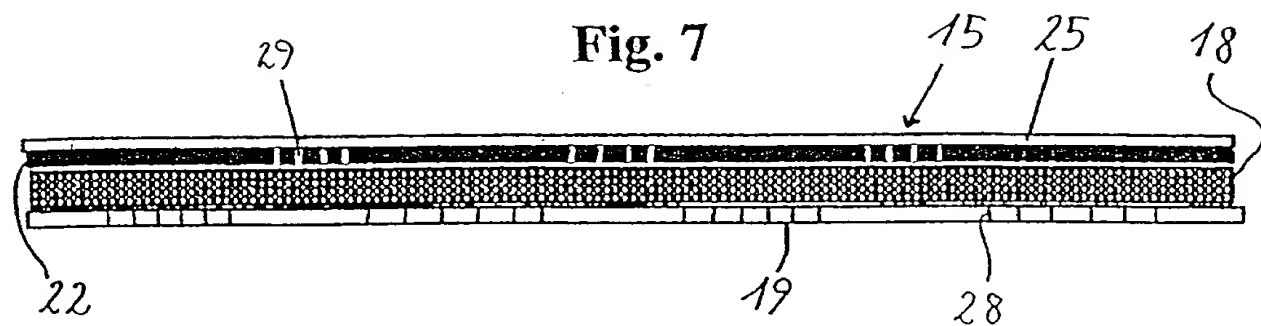
Fig. 6



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INTERNATIONAL SEARCH REPORT

Int. National Application No

PCT/D/00724

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E04D12/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E04D E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 85 00188 A (V.I.K.- CONSULT) 17 January 1985 (1985-01-17) cited in the application the whole document	1-33
A	WO 96 33321 A (FRAUNHOFER-GESELLSCHAFT) 24 October 1996 (1996-10-24) cited in the application & EP148870 (Cited by the applicant) the whole document	1-33
A	EP 0 816 582 A (FRAUNHOFER-GESELLSCHAFT) 7 January 1998 (1998-01-07) column 3, line 10 - line 21	1
A	WO 98 25119 A (ICOPAL A/S) 11 June 1998 (1998-06-11) abstract; figures	1
-/-		

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

27 March 2000

Date of mailing of the international search report

31/03/2000

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No.

/DK 99/00724

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 657 610 A (KOMATSU ET AL.) 14 April 1987 (1987-04-14) the whole document	1
A	DE 30 46 861 A (RÜTGERSWERKE AG) 15 July 1982 (1982-07-15) the whole document	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/D/9/00724

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 8500188 A	17-01-1985	DK 563483 A, B, AT 23381 T EP 0148870 A FI 850680 A, B, JP 4053987 B JP 60501612 T NO 850643 A US 4567080 A	21-12-1984 15-11-1984 24-07-1985 19-02-1985 28-08-1992 26-09-1985 18-02-1985 28-01-1986
WO 9633321 A	24-10-1996	DE 19514420 C AU 695567 B AU 5331896 A BR 9608141 A CA 2215502 A CN 1185821 A CZ 9703218 A EP 0821755 A HU 9802610 A JP 11504088 T NO 974807 A NZ 305338 A PL 322730 A SK 142097 A	06-03-1997 13-08-1998 07-11-1996 09-02-1999 24-10-1996 24-06-1998 18-02-1998 04-02-1998 29-03-1999 06-04-1999 19-12-1997 23-12-1998 16-02-1998 04-02-1998
EP 816582 A	07-01-1998	DE 29611626 U NO 973090 A	12-09-1996 05-01-1998
WO 9825119 A	11-06-1998	AU 5187498 A EP 0943080 A	29-06-1998 22-09-1999
US 4657610 A	14-04-1987	JP 1894566 C JP 5064107 B JP 61202843 A CA 1245964 A EP 0193938 A	26-12-1994 13-09-1993 08-09-1986 06-12-1988 10-09-1986
DE 3046861 A	15-07-1982	NONE	

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 05 APR 2001

14

Applicant's or agent's file reference 22029 PC 1	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK99/00724	International filing date (day/month/year) 21/12/1999	Priority date (day/month/year) 21/12/1998
International Patent Classification (IPC) or national classification and IPC E04D12/00		
Applicant ICOPAL A/S et al.		



1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 20/07/2000	Date of completion of this report 02.04.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kofoed, P Telephone No. +49 89 2399 2927 

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK99/00724

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*
Description, pages:

1-12 as originally filed

Claims, No.:

1-33 as received on 15/12/2000 with letter of 13/12/2000

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/DK99/00724

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-33
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-33
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-33
	No:	Claims	

2. Citations and explanations
see separate sheet

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/DK99/00724

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents, also cited by the applicant:

D1: WO-A-85 00188

D2: WO-A-96 33321

1.1 The invention according to claim 1 relates to a vapour barrier, of the type used in building structures such as roof or wall structures, formed by a pair of water impervious membranes arranged on both sides of a water absorbing material. Further, the invention according to claim 28 relates to a method of producing such a barrier.

1.2 The closest prior art is found in figure 1 of document D1, the two membranes (ref. 1 and 2) having through openings (ref. 5 and 6).

2 The subject-matter of claim 1 is new and also inventive for the following reasons (Articles 33(2)&(3) PCT):

Problem: To further develop such a vapour barrier that

- I - the moisture accumulation in the roof or wall structure, typically due to vapour diffusing from the room during winter conditions, is reduced, and
- II - the efficiency in drying out the roof or wall structure is increased.

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/DK99/00724

The solution according to claim 1 is essentially given by letting a part of the second membrane being of a material of the type having a water vapour diffusion resistance, which varies in dependency of the relative humidity of air in contact therewith, such that the vapour diffusion resistance is reduced when the relative humidity increases, and vice versa.

- 2.1 None of the documents cited in the research report indicate this solution, nor give hints which in combination could lead thereto. The solution of document D1, see figure 1, lacks this component entirely. Document D2 in fact discloses a film or membrane with the above mentioned diffusion properties (see figure 1). However, this film is used in connection with an additional carrier layer, e.g. of paper (see page 4, line 6 - page 6, line 16). In this way the first problem of reducing vapour diffusion is solved. But, the problem of efficiently drying out of the structure remains unsolved. There are no hints towards the solution of the invention, where the drying out is guaranteed both by diffusion, condensation and drainage.
- 3 The industrial applicability is also given (Article 33(4) PCT).
- 4 The related method of producing according to claim 28 also fulfils the requirements of Article 33 PCT.
- 5 Dependent claims 2-27 and 29-33 concern advantageous further developments of the subject-matter according to claim 1 and 28, respectively. They fulfil therefore as well the requirements of Article 33 PCT as regards novelty, inventive step and industrial applicability.

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CLAIMS

1. A water vapour barrier (15) comprising
a first, water impervious membrane (19) having a plurality of first through openings
5 (21,28) defined therein,
a second, water impervious membrane (22) arranged opposite to the first
membrane (19),
water absorbing material (18) being arranged within one or more spaces being
defined between the first and second membranes (19,22), and
10 characterised in that at least part of said second membrane (22) is of a material of
the type having a water vapour diffusion resistance, which varies in dependency of the
relative humidity of air in contact therewith, such that the vapour diffusion resistance is
reduced when the relative humidity increases, and vice versa.
- 15 2. A vapour barrier according to claim 1, wherein a plurality of second through openings
(24,29) are formed in said second membrane (22), and wherein each of said spaces
interconnecting said first openings (21,28) and second openings (24,29).
3. A vapour barrier according to claim 2, wherein the first through openings (21,28) are
20 offset to said second through openings (24,29).
4. A vapour barrier according to any of claims 1-3, wherein the first membrane (19) is
substantially impervious to water vapour.
- 25 5. A vapour barrier according to any of claims 1-4, wherein the first and second
membranes (19,22) are connected to opposite sides of said water absorbing material,
which is in the form of an intermediate layer (18).
6. A vapour barrier according to claim 5, wherein the second through openings (24,29)
30 cover a substantially larger area of the surface of the water absorbing material than the
first through openings (21,28), or vice versa, whereby the vapour transport in the vapour
barrier in a direction from the second membrane to the first membrane is predominant, or
vice versa.

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7. A vapour barrier according to claim 5 or 6, wherein the thickness of the intermediate layer (18) of water absorbing material is 0.2-1.5 mm.
8. A vapour barrier according to any of claim 5-7, wherein the intermediate layer (18) of water absorbing material is a fibrous plastic material comprising fibres having a hydrophobic fibre core.
9. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the first membrane (19) is equivalent to 10-100 m air column at any relative humidity of air in contact therewith.
10. A vapour barrier according to any of the preceding claims, wherein the first membrane is a film or foil (19).
11. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is made from plastic or metallic material.
12. A vapour barrier according to claim 11, wherein the first membrane (19) is made from polyethylene or polypropylene.
13. A vapour barrier according to claim 12, wherein the first membrane (19) comprises a polyethylene film having a weight of 20-100 g/m², preferably 30-80 g/m².
14. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 2 m air column at a relative humidity of 20-50% and less than 1 m air column at a relative humidity of 60-100% of air in contact with the membrane.
15. A vapour barrier according to claim 14, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 5 m air column at a relative humidity of 20-50%.
16. A vapour barrier according to claim 14 or 15, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to less than 0.5 m air column,

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preferably about 0.1 m or less, at a relative humidity of 60-100% of air in contact with the membrane.

17. A vapour barrier according to any of the preceding claims, wherein said at least part of
5 the second membrane (22) is made from at least one material selected from the group consisting of polyamide, ethylene-vinyl alcohol-copolymer, polyvinyl alcohol, polyurethane, protein derivatives, methyl cellulose, cellophane, linseed oil alkyd, and bone glue.
- 10 18. A vapour barrier according to any of the preceding claims, further comprising a moisture distributing outer layer (25) of water absorbing material, which is connected to the outer surface of said first membrane (19) or second membrane (22).
- 15 19. A vapour barrier according to claim 18, wherein the outer layer (25) of water absorbing material is a fibrous, felt-like material.
20. A vapour barrier according to claim 19, wherein the thickness of the outer layer (25) of water absorbing material is less than 0.5 mm, preferably about 0.1 mm.
- 20 21. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is formed by mutually parallel, transversely spaced first bands (20), the first through openings (21) being defined between adjacent first bands (20).
22. A vapour barrier according to any of the preceding claims, wherein the second
25 membrane (22) is formed by mutually parallel, transversely spaced second bands (23), the second through openings (24) being defined between adjacent second bands (23).
23. A vapour barrier according to any of the claims 2-22, wherein the minimum spacing between first and second openings (21,24) defined in the first and second membranes
30 (19,22), respectively, is about 20 mm.
24. A vapour barrier according to claim 22, wherein each of said second bands (23) has a width exceeding the width of a corresponding space (21) between adjacent first bands (20) and overlaps said space and adjacent rim portions of said adjacent first bands.

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25. A vapour barrier according to claim 24, wherein the maximum transverse overlap of the rim portions of the adjacent first bands (20) is 100 mm.

26. A vapour barrier according to claim 25, wherein the maximum transverse overlap is 70 mm.

27. A vapour barrier according to any of the claims 21-26 and being in the form of a web-like material, the parallel, band-shaped openings (21,24) extending in the longitudinal direction of the web-like material.

10

28. A method of making a water vapour barrier, said method comprising
forming an elongated layer of water absorbing, fibrous material (18),
applying to a first side surface of the layer of water absorbing, fibrous material (18)
a plurality of transversely spaced, parallel first bands (20) of a first, water impervious

15 membrane material, and

applying to an opposite, second side surface of the layer of water absorbing,
fibrous material (18) a plurality of transversely spaced, parallel second bands (23), at least
some of which are of a second membrane material, which is of the type having a water
vapour diffusion resistance, which varies in dependency of the relative moisture of air in
contact therewith,

20

each of said second bands (23) having a width exceeding the width of a
corresponding space (21) between adjacent first bands (20) and being applied so as to
overlap said space and adjacent rim portions of said adjacent first bands.

25 29. A method according to claim 28, wherein said first membrane material is substantially
impervious to water vapour.

30. A method according to claim 28 or 29, wherein at least some of said first and second
bands (20,23) are films or foils which are adhered to the side surfaces of the layer of
water absorbing fibrous material (18).

30

31. A method according to claim 29 or 30, wherein the first bands (20) are polyethylene
films or foils which are connected to thermoplastic fibres of the layer (18) of water
absorbing material by heating and fusing.

35

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32. A method according to any of the claims 28-31, wherein at least some of the second bands (23) are fastened to the layer of water absorbing material (18) by means of a glue.

33. A method according to claim 32, wherein net-like bands of a suitable polymer glue are
5 interposed between said second bands (23) and the layer of water absorbing material (18).

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PCT

For Receiving Office use only

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference

(if desired) (12 characters maximum)

22029 PC 1

Box No. I TITLE OF INVENTION

A WATER VAPOUR BARRIER AND A METHOD OF MAKING THE SAME

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Icopal A/S
Amager Landevej 233
DK-2770 Kastrup

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

DK

State (that is, country) of residence:

DK

This person is applicant for the purposes of:



all designated States



all designated States except the United States of America



the United States of America only



the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

HARDER, Sven
Bybakken 6
DK-2625 Vallensbæk

This person is:

☐ applicant only☒ applicant and inventor☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

DK

State (that is, country) of residence:

DK

This person is applicant for the purposes of:



all designated States



all designated States except the United States of America



the United States of America only



the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:



agent



common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Plogmann, Vingtoft & Partners A/S
Sankt Annæ Plads 11
P.O. Box 3007
DK-1021 Copenhagen K

Telephone No.

+45 33 63 93 00

Facsimile No.

+45 33 63 96 00

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

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Box No.V DESIGNATION STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ **AP** ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|---|---|
| <input checked="" type="checkbox"/> AE United Arab Emirates | <input checked="" type="checkbox"/> LR Liberia |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria and utility model | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> CZ Czech Republic and utility model | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DE Germany and utility model | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> DK Denmark and utility model | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia and utility model | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> FI Finland and utility model | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia and utility model |
| <input checked="" type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IN India | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> ZA South Africa |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input checked="" type="checkbox"/> KR Republic of Korea and utility model | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |
| <input checked="" type="checkbox"/> LK Sri Lanka | |

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ **DM** Dominica ☒ **MA** Morocco
- ☒ **CR** Costa Rica ☒ **TZ** Tanzania

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

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Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claim indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: * regional Office	international application: - receiving Office
item (1) 21.12.1998 21 December 1998	PA 1998 01698	DK		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 1

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / EP

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)

1 July 1999

RS 103120 DK

EP

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 3

description (excluding sequence listing part) : 12

claims : 5

abstract : 1

drawings : 3

sequence listing part of description : _____

Total number of sheets : 24

This international application is accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other (specify):

Figure of the drawings which should accompany the abstract: 2

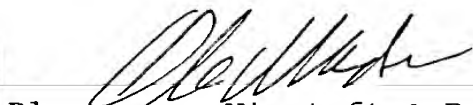
Language of filing of the international application:

English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Copenhagen, 21 December 1999



Plougmann, Vingtoft & Partners A/S

For receiving Office use only		2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

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The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

20 JUL 2000

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference 22029 PC 1	
International application No. PCT/DK99/00724	International filing date (day/month/year) 21 December 1999
(Earliest) Priority date (day/month/year) 21 December 1998	
Title of invention A WATER VAPOUR BARRIER AND A METHOD OF MAKING THE SAME	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) Icopal A/S Amager Landevej 233 DK-2770 Kastrup Denmark	Telephone No.: Facsimile No.: Teleprinter No.:
State (that is, country) of nationality: DK	State (that is, country) of residence: DK
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) HARDER, Sven Bybakken 6 DK-2625 Vallensbæk Denmark	
State (that is, country) of nationality: DK	State (that is, country) of residence: DK
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) 	
State (that is, country) of nationality:	State (that is, country) of residence:
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.	

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Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*Plougmann, Vingtoft & Partners A/S
Sankt Annæ Plads 11
P.O. Box 3007
DK-1021 Copenhagen K
Denmark

Telephone No.:

+45 33 63 93 00

Facsimile No.:

+45 33 63 96 00

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☐ as originally filed
☐ as amended under Article 34the claims ☐ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34the drawings ☐ as originally filed
☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

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Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

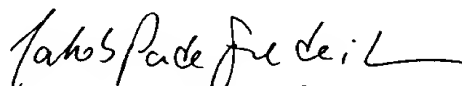
The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (specify): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Copenhagen, 20 July 2000



Plougmann, Vingtoft & Partners A/S

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

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PATENT COOPERATION TREATY

W. G. O. P.
& PARTNERS

30 OCT. 2000

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

PLOUGMANN VINGTOFT
& PARTNERS A/S
Sankt Annae Plads 11
P.O. Box 3007
DK-1021 Copenhagen K
DANEMARK

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing
(day/month/year) 27.10.2000

Applicant's or agent's file reference
22029 PC 1

REPLY DUE within 3 month(s)
from the above date of mailing

International application No.
PCT/DK99/00724

International filing date (day/month/year)
21/12/1999

Priority date (day/month/year)
21/12/1998

International Patent Classification (IPC) or both national classification and IPC
E04D12/00

Applicant
ICOPAL A/S et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain document cited
 - VII ☐ Certain defects in the international application
 - VIII ☒ Certain observations on the international application
3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 21/04/2001.

Name and mailing address of the international preliminary examining authority:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer / Examiner

Kofoed, P

Formalities officer (incl. extension of time limits)
Beuschel, H
Telephone No. +49 89 2399 2971



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I. Basis of the opinion

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

Description, pages:

1-12 as originally filed

Claims, No.:

1-33 as originally filed

Drawings, sheets:

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	1-33 yes
Inventive step (IS)	Claims	1-33 yes
Industrial applicability (IA)	Claims	1-33 yes

2. Citations and explanations

see separate sheet

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VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents, also cited by the applicant:

D1: WO-A-85 00188

D2: WO-A-96 33321

1.1 The invention according to claim 1 relates to a vapour barrier, of the type used in building structures such as roof or wall structures, formed by a pair of water impervious membranes arranged on both sides of a water absorbing material. Further, the invention according to claim 28 relates to a method of producing such a barrier.

1.2 The closest prior art is found in figure 1 of document D1, the two membranes (ref. 1 and 2) having through openings (ref. 5 and 6).

2 The subject-matter of claim 1 is new and also inventive for the following reasons (Articles 33(2)&(3) PCT):

Problem: To further develop such a vapour barrier that

- I - the moisture accumulation in the roof or wall structure, typically due to vapour diffusing from the room during winter conditions, is reduced, and

- II - the efficiency in drying out the roof or wall structure is increased.

The solution according to claim 1 is essentially given by letting a part of the second membrane being of a material of the type having a water vapour diffusion resistance, which varies in dependency of the relative humidity of air in contact therewith, such that the vapour diffusion resistance is reduced when the relative humidity increases, and vice versa.

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- 2.1 None of the documents cited in the research report indicate this solution, nor give hints which in combination could lead thereto. The solution of document D1, see figure 1, lacks this component entirely. Document D2 in fact discloses a film or membrane with the above mentioned diffusion properties (see figure 1). However, this film is used in connection with an additional carrier layer, e.g. of paper (see page 4, line 6 - page 6, line 16). In this way the first problem of reducing vapour diffusion is solved. But, the problem of efficiently drying out of the structure remains unsolved. There are no hints towards the solution of the invention, where the drying out is guaranteed both by diffusion, condensation and drainage.
- 3 The industrial applicability is also given (Article 33(4) PCT).
- 4 The related method of producing according to claim 28 also fulfils the requirements of Article 33 PCT.
- 5 Dependent claims 2-27 and 29-33 concern advantageous further developments of the subject-matter according to claim 1 and 28, respectively. They fulfil therefore as well the requirements of Article 33 PCT as regards novelty, inventive step and industrial applicability.

Re Item VIII

Certain observations on the international application

- 6 Due to the dual use of the expression "or vice versa" in claim 6 the subject-matter of this claim is unclear (Article 6 PCT). The following formulation is proposed: "A vapour barrier according to claim 5, wherein either the second through openings (24, 29) cover a substantially larger area of the surface of the water absorbing material than the first through openings (21, 28), whereby the vapour transport in the vapour barrier in a direction from the second membrane to the first membrane is predominant, or the first through openings (21, 28) cover a substantially larger area of the surface of the water absorbing material than the second through openings (24, 29), whereby the vapour transport in the vapour barrier in a direction from the first membrane to the second membrane is predominant".

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European Patent Office
D-80298 München
Tyskland

BY TELEFAX AND CONFIRMATION BY MAIL

PCT CHAPTER II

Copenhagen, 13 December 2000

International Patent Application No. PCT/DK99/00724
Publication No. WO 00/37751
Icopal A/S
A water vapour barrier and a method of making the same
Our ref: 22029 PC 1

Dear Sirs,

Referring to the written opinion dated 27 October 2000 we hereby submit a set of amended claims, wherein we have amended claim 6 in accordance with the recommendations of the Examiner (cf. "Re Item VIII" in the written opinion).

We enclose two copies of the set of amended claims; one copy indicating the amendments and one fair copy.

If the Examiner does not agree that the invention defined in the new claims is novel and involves an inventive step, a telephone interview with the Examiner pursuant to Rule 66.6 PCT is requested prior to the issuance of the Preliminary Examination Report.

Yours sincerely,

Plougmann, Vingtoft & Partners


Ole Christian Madsen

Two copies of the amended set of claims
EPO form 1037

13 DEC 2000

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International Patent Application No. PCT/DK99/00724

Publication No. WO 00/37751

Icopal A/S

A water vapour barrier and a method of making the same

5 Our ref: 22029 PC 1

New claims, 13 December 2000

- 10 1. A water vapour barrier (15) comprising
a first, water impervious membrane (19) having a plurality of first through openings
(21,28) defined therein,
a second, water impervious membrane (22) arranged opposite to the first
membrane (19),
15 water absorbing material (18) being arranged within one or more spaces being
defined between the first and second membranes (19,22), and
characterised in that at least part of said second membrane (22) is of a material of
the type having a water vapour diffusion resistance, which varies in dependency of the
relative humidity of air in contact therewith, such that the vapour diffusion resistance is
20 reduced when the relative humidity increases, and vice versa.
2. A vapour barrier according to claim 1, wherein a plurality of second through openings
(24,29) are formed in said second membrane (22), and wherein each of said spaces
interconnecting said first openings (21,28) and second openings (24,29).
- 25 3. A vapour barrier according to claim 2, wherein the first through openings (21,28) are
offset to said second through openings (24,29).
4. A vapour barrier according to any of claims 1-3, wherein the first membrane (19) is
30 substantially impervious to water vapour.
5. A vapour barrier according to any of claims 1-4, wherein the first and second
membranes (19,22) are connected to opposite sides of said water absorbing material,
which is in the form of an intermediate layer (18).

35

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6. A vapour barrier according to claim 5, wherein either the second through openings (24,29) cover a substantially larger area of the surface of the water absorbing material than the first through openings (21,28), whereby the vapour transport in the vapour barrier in a direction from the second membrane to the first membrane is predominant, or the first
- 5 through openings (21,28) cover a substantially larger area of the surface of the water absorbing material than the second through openings (24,29), whereby the vapour transport in the vapour barrier in a direction from the first membrane to the second membrane is predominant.
- 10 7. A vapour barrier according to claim 5 or 6, wherein the thickness of the intermediate layer (18) of water absorbing material is 0.2-1.5 mm.
8. A vapour barrier according to any of claim 5-7, wherein the intermediate layer (18) of water absorbing material is a fibrous plastic material comprising fibres having a
- 15 hydrophobic fibre core.
9. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the first membrane (19) is equivalent to 10-100 m air column at any relative humidity of air in contact therewith.
- 20 10. A vapour barrier according to any of the preceding claims, wherein the first membrane is a film or foil (19).
11. A vapour barrier according to any of the preceding claims, wherein the first membrane
- 25 (19) is made from plastic or metallic material.
12. A vapour barrier according to claim 11, wherein the first membrane (19) is made from polyethylene or polypropylene.
- 30 13. A vapour barrier according to claim 12, wherein the first membrane (19) comprises a polyethylene film having a weight of 20-100 g/m², preferably 30-80 g/m².
14. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 2 m air column

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at a relative humidity of 20-50% and less than 1 m air column at a relative humidity of 60-100% of air in contact with the membrane.

15. A vapour barrier according to claim 14, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 5 m air column at a relative humidity of 20-50%.

16. A vapour barrier according to claim 14 or 15, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to less than 0.5 m air column, preferably about 0.1 m or less, at a relative humidity of 60-100% of air in contact with the membrane.

17. A vapour barrier according to any of the preceding claims, wherein said at least part of the second membrane (22) is made from at least one material selected from the group consisting of polyamide, ethylene-vinyl alcohol-copolymer, polyvinyl alcohol, polyurethane, protein derivatives, methyl cellulose, cellophane, linseed oil alkyd, and bone glue.

18. A vapour barrier according to any of the preceding claims, further comprising a moisture distributing outer layer (25) of water absorbing material, which is connected to the outer surface of said first membrane (19) or second membrane (22).

19. A vapour barrier according to claim 18, wherein the outer layer (25) of water absorbing material is a fibrous, felt-like material.

20. A vapour barrier according to claim 19, wherein the thickness of the outer layer (25) of water absorbing material is less than 0.5 mm, preferably about 0.1 mm.

21. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is formed by mutually parallel, transversely spaced first bands (20), the first through openings (21) being defined between adjacent first bands (20).

22. A vapour barrier according to any of the preceding claims, wherein the second membrane (22) is formed by mutually parallel, transversely spaced second bands (23), the second through openings (24) being defined between adjacent second bands (23).

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23. A vapour barrier according to any of the claims 2-22, wherein the minimum spacing between first and second openings (21,24) defined in the first and second membranes (19,22), respectively, is about 20 mm.

5

24. A vapour barrier according to claim 22, wherein each of said second bands (23) has a width exceeding the width of a corresponding space (21) between adjacent first bands (20) and overlaps said space and adjacent rim portions of said adjacent first bands.

10 25. A vapour barrier according to claim 24, wherein the maximum transverse overlap of the rim portions of the adjacent first bands (20) is 100 mm.

26. A vapour barrier according to claim 25, wherein the maximum transverse overlap is 70 mm.

15

27. A vapour barrier according to any of the claims 21-26 and being in the form of a web-like material, the parallel, band-shaped openings (21,24) extending in the longitudinal direction of the web-like material.

20 28. A method of making a water vapour barrier, said method comprising
forming an elongated layer of water absorbing, fibrous material (18),
applying to a first side surface of the layer of water absorbing, fibrous material (18)
a plurality of transversely spaced, parallel first bands (20) of a first, water impervious
membrane material, and

25 applying to an opposite, second side surface of the layer of water absorbing,
fibrous material (18) a plurality of transversely spaced, parallel second bands (23), at least
some of which are of a second membrane material, which is of the type having a water
vapour diffusion resistance, which varies in dependency of the relative moisture of air in
contact therewith,

30 each of said second bands (23) having a width exceeding the width of a
corresponding space (21) between adjacent first bands (20) and being applied so as to
overlap said space and adjacent rim portions of said adjacent first bands.

29. A method according to claim 28, wherein said first membrane material is substantially
35 impervious to water vapour.

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30. A method according to claim 28 or 29, wherein at least some of said first and second bands (20,23) are films or foils which are adhered to the side surfaces of the layer of water absorbing fibrous material (18).

5

31. A method according to claim 29 or 30, wherein the first bands (20) are polyethylene films or foils which are connected to thermoplastic fibres of the layer (18) of water absorbing material by heating and fusing.

10 32. A method according to any of the claims 28-31, wherein at least some of the second bands (23) are fastened to the layer of water absorbing material (18) by means of a glue.

33. A method according to claim 32, wherein net-like bands of a suitable polymer glue are interposed between said second bands (23) and the layer of water absorbing material

15 (18).

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- 4 APR. 2001

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

PLOUGMANN VINGTOFT
& PARTNERS A/S
Sankt Annae Plads 11
P.O. Box 3007
DK-1021 Copenhagen K
DANEMARK

PCT

OCM/101NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year) 02.04.2001Applicant's or agent's file reference
22029 PC 1

IMPORTANT NOTIFICATION

International application No.
PCT/DK99/00724International filing date (day/month/year)
21/12/1999Priority date (day/month/year)
21/12/1998Applicant
ICOPAL A/S et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 22029 PC 1		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK99/00724	International filing date (day/month/year) 21/12/1999	Priority date (day/month/year) 21/12/1998	
International Patent Classification (IPC) or national classification and IPC E04D12/00			
Applicant ICOPAL A/S et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 20/07/2000	Date of completion of this report 02.04.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kofoed, P Telephone No. +49 89 2399 2927



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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/DK99/00724

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-12 as originally filed

Claims, No.:

1-33 as received on 15/12/2000 with letter of 13/12/2000

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/DK99/00724

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-33
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-33
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-33
	No:	Claims	

2. Citations and explanations
see separate sheet

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/DK99/00724

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents, also cited by the applicant:

D1: WO-A-85 00188

D2: WO-A-96 33321

1.1 The invention according to claim 1 relates to a vapour barrier, of the type used in building structures such as roof or wall structures, formed by a pair of water impervious membranes arranged on both sides of a water absorbing material. Further, the invention according to claim 28 relates to a method of producing such a barrier.

1.2 The closest prior art is found in figure 1 of document D1, the two membranes (ref. 1 and 2) having through openings (ref. 5 and 6).

2 The subject-matter of claim 1 is new and also inventive for the following reasons (Articles 33(2)&(3) PCT):

Problem: To further develop such a vapour barrier that

- I - the moisture accumulation in the roof or wall structure, typically due to vapour diffusing from the room during winter conditions, is reduced, and
- II - the efficiency in drying out the roof or wall structure is increased.

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The solution according to claim 1 is essentially given by letting a part of the second membrane being of a material of the type having a water vapour diffusion resistance, which varies in dependency of the relative humidity of air in contact therewith, such that the vapour diffusion resistance is reduced when the relative humidity increases, and vice versa.

- 2.1 None of the documents cited in the research report indicate this solution, nor give hints which in combination could lead thereto. The solution of document D1, see figure 1, lacks this component entirely. Document D2 in fact discloses a film or membrane with the above mentioned diffusion properties (see figure 1). However, this film is used in connection with an additional carrier layer, e.g. of paper (see page 4, line 6 - page 6, line 16). In this way the first problem of reducing vapour diffusion is solved. But, the problem of efficiently drying out of the structure remains unsolved. There are no hints towards the solution of the invention, where the drying out is guaranteed both by diffusion, condensation and drainage.
- 3 The industrial applicability is also given (Article 33(4) PCT).
- 4 The related method of producing according to claim 28 also fulfils the requirements of Article 33 PCT.
- 5 Dependent claims 2-27 and 29-33 concern advantageous further developments of the subject-matter according to claim 1 and 28, respectively. They fulfil therefore as well the requirements of Article 33 PCT as regards novelty, inventive step and industrial applicability.

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International Patent Application No. PCT/DK99/00724

Publication No. WO 00/37751

Icopal A/S

A water vapour barrier and a method of making the same

5 Our ref: 22029 PC 1

New claims, 13 December 2000

- 10 1. A water vapour barrier (15) comprising
a first, water impervious membrane (19) having a plurality of first through openings
(21,28) defined therein,
a second, water impervious membrane (22) arranged opposite to the first
membrane (19),
15 water absorbing material (18) being arranged within one or more spaces being
defined between the first and second membranes (19,22), and
characterised in that at least part of said second membrane (22) is of a material of
the type having a water vapour diffusion resistance, which varies in dependency of the
relative humidity of air in contact therewith, such that the vapour diffusion resistance is
20 reduced when the relative humidity increases, and vice versa.
2. A vapour barrier according to claim 1, wherein a plurality of second through openings
(24,29) are formed in said second membrane (22), and wherein each of said spaces
interconnecting said first openings (21,28) and second openings (24,29).
- 25 3. A vapour barrier according to claim 2, wherein the first through openings (21,28) are
offset to said second through openings (24,29).
4. A vapour barrier according to any of claims 1-3, wherein the first membrane (19) is
30 substantially impervious to water vapour.
5. A vapour barrier according to any of claims 1-4, wherein the first and second
membranes (19,22) are connected to opposite sides of said water absorbing material,
which is in the form of an intermediate layer (18).

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6. A vapour barrier according to claim 5, wherein the second through openings (24,29) cover a substantially larger area of the surface of the water absorbing material than the first through openings (21,28), or vice versa, whereby the vapour transport in the vapour barrier in a direction from the second membrane to the first membrane is predominant, or
5 vice versa.

6. A vapour barrier according to claim 5, wherein either the second through openings (24,29) cover a substantially larger area of the surface of the water absorbing material than the first through openings (21,28), whereby the vapour
10 transport in the vapour barrier in a direction from the second membrane to the first membrane is predominant, or the first through openings (21,28) cover a substantially larger area of the surface of the water absorbing material than the second through openings (24,29), whereby the vapour transport in the vapour barrier in a direction from the first membrane to the second membrane is
15 predominant.

7. A vapour barrier according to claim 5 or 6, wherein the thickness of the intermediate layer (18) of water absorbing material is 0.2-1.5 mm.

20 8. A vapour barrier according to any of claim 5-7, wherein the intermediate layer (18) of water absorbing material is a fibrous plastic material comprising fibres having a hydrophobic fibre core.

9. A vapour barrier according to any of the preceding claims, wherein the water vapour
25 diffusion resistance of the first membrane (19) is equivalent to 10-100 m air column at any relative humidity of air in contact therewith.

10. A vapour barrier according to any of the preceding claims, wherein the first membrane is a film or foil (19).
30

11. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is made from plastic or metallic material.

12. A vapour barrier according to claim 11, wherein the first membrane (19) is made from
35 polyethylene or polypropylene.

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13. A vapour barrier according to claim 12, wherein the first membrane (19) comprises a polyethylene film having a weight of 20-100 g/m², preferably 30-80 g/m².
- 5 14. A vapour barrier according to any of the preceding claims, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 2 m air column at a relative humidity of 20-50% and less than 1 m air column at a relative humidity of 60-100% of air in contact with the membrane.
- 10 15. A vapour barrier according to claim 14, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to at least 5 m air column at a relative humidity of 20-50%.
- 15 16. A vapour barrier according to claim 14 or 15, wherein the water vapour diffusion resistance of the second membrane (22) is equivalent to less than 0.5 m air column, preferably about 0.1 m or less, at a relative humidity of 60-100% of air in contact with the membrane.
- 20 17. A vapour barrier according to any of the preceding claims, wherein said at least part of the second membrane (22) is made from at least one material selected from the group consisting of polyamide, ethylene-vinyl alcohol-copolymer, polyvinyl alcohol, polyurethane, protein derivatives, methyl cellulose, cellophane, linseed oil alkyd, and bone glue.
- 25 18. A vapour barrier according to any of the preceding claims, further comprising a moisture distributing outer layer (25) of water absorbing material, which is connected to the outer surface of said first membrane (19) or second membrane (22).
- 30 19. A vapour barrier according to claim 18, wherein the outer layer (25) of water absorbing material is a fibrous, felt-like material.
20. A vapour barrier according to claim 19, wherein the thickness of the outer layer (25) of water absorbing material is less than 0.5 mm, preferably about 0.1 mm.

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21. A vapour barrier according to any of the preceding claims, wherein the first membrane (19) is formed by mutually parallel, transversely spaced first bands (20), the first through openings (21) being defined between adjacent first bands (20).
- 5 22. A vapour barrier according to any of the preceding claims, wherein the second membrane (22) is formed by mutually parallel, transversely spaced second bands (23), the second through openings (24) being defined between adjacent second bands (23).
23. A vapour barrier according to any of the claims 2-22, wherein the minimum spacing
10 between first and second openings (21,24) defined in the first and second membranes (19,22), respectively, is about 20 mm.
24. A vapour barrier according to claim 22, wherein each of said second bands (23) has a width exceeding the width of a corresponding space (21) between adjacent first bands
15 (20) and overlaps said space and adjacent rim portions of said adjacent first bands.
25. A vapour barrier according to claim 24, wherein the maximum transverse overlap of the rim portions of the adjacent first bands (20) is 100 mm.
- 20 26. A vapour barrier according to claim 25, wherein the maximum transverse overlap is 70 mm.
27. A vapour barrier according to any of the claims 21-26 and being in the form of a web-like material, the parallel, band-shaped openings (21,24) extending in the longitudinal
25 direction of the web-like material.
28. A method of making a water vapour barrier, said method comprising
forming an elongated layer of water absorbing, fibrous material (18),
applying to a first side surface of the layer of water absorbing, fibrous material (18)
30 a plurality of transversely spaced, parallel first bands (20) of a first, water impervious membrane material, and
applying to an opposite, second side surface of the layer of water absorbing, fibrous material (18) a plurality of transversely spaced, parallel second bands (23), at least some of which are of a second membrane material, which is of the type having a water

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vapour diffusion resistance, which varies in dependency of the relative moisture of air in contact therewith,

- each of said second bands (23) having a width exceeding the width of a corresponding space (21) between adjacent first bands (20) and being applied so as to overlap said space and adjacent rim portions of said adjacent first bands.

29. A method according to claim 28, wherein said first membrane material is substantially impervious to water vapour.

30. A method according to claim 28 or 29, wherein at least some of said first and second bands (20,23) are films or foils which are adhered to the side surfaces of the layer of water absorbing fibrous material (18).

31. A method according to claim 29 or 30, wherein the first bands (20) are polyethylene films or foils which are connected to thermoplastic fibres of the layer (18) of water absorbing material by heating and fusing.

32. A method according to any of the claims 28-31, wherein at least some of the second bands (23) are fastened to the layer of water absorbing material (18) by means of a glue.

33. A method according to claim 32, wherein net-like bands of a suitable polymer glue are interposed between said second bands (23) and the layer of water absorbing material (18).

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PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

PLOUGMANN, VINGTOFT & PARTNERS A/S
Sankt Annæ Plads 11
P.O. Box 3007
DK-1021 Copenhagen K
DANEMARK

PLOUGMANN
VINGTOFT
& PARTNERS

07 JULI 2000

OCM/umr

Date of mailing (day/month/year) 29 June 2000 (29.06.00)		
Applicant's or agent's file reference 22029 PC 1		
IMPORTANT NOTICE		
International application No. PCT/DK99/00724	International filing date (day/month/year) 21 December 1999 (21.12.99)	Priority date (day/month/year) 21 December 1998 (21.12.98)
Applicant ICOPAL A/S et al		

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,CN,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,GE,
GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,NO,NZ,
OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 29 June 2000 (29.06.00) under No. WO 00/37751

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38



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